

INSTRUMENT OPTICS

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The coming era of microspacecraft is challenging us to produce optical instruments that are an order of magnitude smaller and lighter than those used in the past. No longer can telescopes and imaging spectrometers weigh 50 kg. The question today is how much science can be done with a 5 kg instrument. We are developing the component technologies and new instrument designs that will provide the greatest science return from these small instruments.

We are working on design and fabrication of binary optical[?] gratings to enable compact imaging spectrometer designs. Unlike holographic gratings, ~~were limited~~ aberration correction comes at the cost of low diffraction efficiency, binary optical gratings provide very good aberration correction with high diffraction efficiency. The development of these gratings is being done by at a state-of-the-art electron beam fabrication facility in the Microdevices Laboratory at JPL. The challenge in the grating fabrication is to lower their stray light for use in the visible and near infrared regions.

In thin films, we recently developed high efficiency broadband anti-reflection coatings, with low polarization sensitivity for the Multi-Angle Imaging Spectroradiometer instrument. We have also been developing Rugate filters for their applications in multispectral filters, and ultra-smooth mirror surfaces (less than 1 Angstrom surface roughness) for low scattered light telescope systems.

In the instrument design area, we recently produced a compact design for the Pluto Fast Flyby mission, consisting of a visible camera and imaging spectrometers for both the infrared and, far ultraviolet. These are combined into one instrument, whereas in all previous spacecraft the camera and imaging spectrometer have been separate instruments. Our integrated design saves weight, resulting in a lightweight instrument suitable for the small spacecraft. The mirrors and structure of this system will be of either beryllium or silicon carbide.